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SEQUENCE LISTING

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<120> Synthesis of Oligosaccharides, Glycolipids and  
Glycoproteins Using Bacterial Glycosyltransferases

<130> 019957-015920US

<140> US 11/521,138  
<141> 2005-01-11

<150> US 60/398,156  
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<150> US 60/424,894  
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<151> 2003-07-23

<160> 76

<170> PatentIn Ver. 2.1

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alpha-1,3/4-fucosyltransferase

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gaattttaaa agaacattct ttattttatt ctcagtcagc attacacaat caccctccac 180  
caaaacccca acgaaccctc cgatctcgtc tttggcagtc ctattggatc agccagaaaa 240  
atcttacccat atcaaaacgc aaaaagagtg ttttacaccg gtgaaaacga atcgccataat 300  
ttcaacctct ttgattacgc cataggctt gatgaattgg atttttagaga tcgttattta 360  
agaatgcctt tatattatga tagactacac cataaagccg agagcgtgaa tgacaccact 420  
tcgccttaca aactcaaacc tgacagcctt tatgtttaa aaaaacccctc ccatcatttt 480  
aaagaaaacc accccaattt atgcgcagta gtgaacaatg agagcgatcc tttgaaaaga 540  
gggtttgcga gttttgttagc gagcaaccct aacgctccta aaaggaatgc tttctatgac 600  
gttttaattt ctatagagcc agttattggg ggagggagcg tgaaaaacac tttaggctat 660  
aacattaaaa acaagagcga gtttttaagc caatacaaat tcaatctgtg ttttggaaac 720  
tcacaaggct atggctatgt aactgaaaaa atcattgacg cttacttttag ccataccatt 780  
ccatattttt gggggagtcc tagcgtggca caagattttt accctaagag ttttggat 840  
gtttgtgatt ttaaagattt tgatgaagcg attgatcatg tgcgatactt gcacacgcac 900  
ccaaacgcctt atttagacat gctttatgaa aaccctttaa acacccttga tgggaaagct 960  
tacttttacc aaaatttgag tttttaaaaaa atcctagatt tttttaaaac gattttagaa 1020

aacgacacga tttatcacga taaccctttt attttttatac gtgatttgaa tgagccgtta 1080  
atatcttattt atgatgattt gagggtaat tatgatgatt tgagggttaa ttatgatgat 1140  
ttgagggtta attatgatga tttgagggtt aattatgatg atttgggtt taattatgat 1200  
gatttgggg ttaattatga tgatttgagg gttaattatg atgatttgag ggttaattat 1260  
gatgatttga gggtaatta tgatgattt aggttaattt atgatgattt gagggttaat 1320  
tatgagcggc tcttacaaaa cgcctcgcc ttattagaac tctctcaaaa caccacttt 1380  
aaaatctatc gcaaagctta tcaaaaatcc ttacctttgt tgcgtgcggc gagaaagttg 1440  
ataaaaaaat tgggtttgt a 1461

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alpha-1,3/4-fucosyltransferase

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1 5 10 15

Lys Ile Thr Ser Lys Ser Pro Pro Leu Lys Ile Ala Val Ala Asn  
20 25 30

Trp Trp Gly Asp Glu Glu Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr  
35 40 45

Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Gln Asn Pro Asn  
50 55 60

Glu Pro Ser Asp Leu Val Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys  
65 70 75 80

Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn  
85 90 95

Glu Ser Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu  
100 105 110

Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg  
115 120 125

Leu His His Lys Ala Glu Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys  
130 135 140

Leu Lys Pro Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe  
145 150 155 160

Lys Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp  
165 170 175

Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala  
180 185 190

Pro Lys Arg Asn Ala Phe Tyr Asp Val Leu Asn Ser Ile Glu Pro Val  
195 200 205

Ile Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn  
210 215 220

Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn  
 225 230 235 240  
 Ser Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe  
 245 250 255  
 Ser His Thr Ile Pro Ile Tyr Trp Gly Ser Pro Ser Val Ala Gln Asp  
 260 265 270  
 Phe Asn Pro Lys Ser Phe Val Asn Val Cys Asp Phe Lys Asp Phe Asp  
 275 280 285  
 Glu Ala Ile Asp His Val Arg Tyr Leu His Thr His Pro Asn Ala Tyr  
 290 295 300  
 Leu Asp Met Leu Tyr Glu Asn Pro Leu Asn Thr Leu Asp Gly Lys Ala  
 305 310 315 320  
 Tyr Phe Tyr Gln Asn Leu Ser Phe Lys Lys Ile Leu Asp Phe Phe Lys  
 325 330 335  
 Thr Ile Leu Glu Asn Asp Thr Ile Tyr His Asp Asn Pro Phe Ile Phe  
 340 345 350  
 Tyr Arg Asp Leu Asn Glu Pro Leu Ile Ser Ile Asp Asp Asp Leu Arg  
 355 360 365  
 Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn  
 370 375 380  
 Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp  
 385 390 395 400  
 Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu  
 405 410 415  
 Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val  
 420 425 430  
 Asn Tyr Asp Asp Leu Arg Val Asn Tyr Glu Arg Leu Leu Gln Asn Ala  
 435 440 445  
 Ser Pro Leu Leu Glu Leu Ser Gln Asn Thr Thr Phe Lys Ile Tyr Arg  
 450 455 460  
 Lys Ala Tyr Gln Lys Ser Leu Pro Leu Leu Arg Ala Ala Arg Lys Leu  
 465 470 475 480  
 Ile Lys Lys Leu Gly Leu  
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<210> 3  
 <211> 1299  
 <212> DNA  
 <213> Helicobacter pylori  
  
 <220>  
 <223> Helicobacter pylori strain 1111 FutA  
 alpha-1,3/4-fucosyltransferase

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 aatctccccc ccctaaaaat cgctgtggcg aattggtggg gagatgaaga aattaaaaaa 120  
 tttaaaaaga gcgttctta tttatccta agccagcatt acacaatcac ttacaccga 180  
 aaccctgata aacctgcgga catcgcttt ggtaaaaacc ttggatcagc cagaaaaatc 240  
 ttatcctatc aaaacgcaaa aagggtgtt tacaccggtg aaaatgaagt ccctaacttc 300  
 aacctcttg attacgcccatt aggcattgtt gaattggact ttagagatcg ttatggaga 360  
 atgcctttgtt attatgccta ttgcattaa aagccgagc ttgttaatga caccacttcg 420  
 ccttataaac tccaaacctga cagcctttt gctttaaaaa aaccctccca tcattttaaa 480  
 gaaaaccacc ccaatttgcg cgcagtagt aataatgaga gtgatcctt gaaaagaggg 540  
 tttgcgagct ttgtcgcaag caaccctaaac gctccttagaa ggaacgcctt ttatggggct 600  
 ttaaacgccta ttgagccagt tgctggggga gggagcgtga aaaacactt aggctataat 660  
 gtcaaaaaca agagcgagtt ttaagccaa tacaattca atctgtgttt tgaaaacact 720  
 caaggctatg gctatgtaac taaaagatc attgacgctt atttcagcca taccattcc 780  
 atttatttggg ggagtcccg cgtggcgaaa gattttaaacc ctaagagttt tgcgtatgtc 840  
 catgatttca acaactttga tgaagcgtt gactatatca gatacttgc cacgcaccc 900  
 aacgcttatt tagacatgca ctatgaaaac cctttaaaca ctattgtatgg gaaagcttac 960  
 ttttacccaa atttgagttt taaaaaaatc ctagattttt ttaaaacgtt tttagaaaaac 1020  
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 tctattgtatg gtttgagggt taattatgtt gatttgaggg ttaattatgtt tgatttgagg 1140  
 gtaattatg atgatttgag ggttaattat gaggccctt tacaaaacgc ctcgccttta 1200  
 ttagaactct ctcaaaacac cactttaaa atctatcgca aagcttatca aaaatcctt 1260  
 cctttgtgc gtgccataag gagatgggtt aaaaagtaa 1299

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 <213> *Helicobacter pylori*

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 alpha-1,3/4-fucosyltransferase

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 Lys Trp Pro Leu Asn Leu Pro Pro Leu Lys Ile Ala Val Ala Asn Trp  
 20 25 30  
  
 Trp Gly Asp Glu Glu Ile Lys Lys Phe Lys Lys Ser Val Leu Tyr Phe  
 35 40 45  
  
 Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Arg Asn Pro Asp Lys  
 50 55 60  
  
 Pro Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile  
 65 70 75 80  
  
 Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu  
 85 90 95  
  
 Val Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu  
 100 105 110  
  
 Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Ala Tyr Leu  
 115 120 125  
  
 His Tyr Lys Ala Glu Leu Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu  
 130 135 140

Gln Pro Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys  
 145 150 155 160  
 Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp Pro  
 165 170 175  
 Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro  
 180 185 190  
 Arg Arg Asn Ala Phe Tyr Glu Ala Leu Asn Ala Ile Glu Pro Val Ala  
 195 200 205  
 Gly Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Val Lys Asn Lys  
 210 215 220  
 Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Thr  
 225 230 235 240  
 Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe Ser  
 245 250 255  
 His Thr Ile Pro Ile Tyr Trp Gly Ser Pro Ser Val Ala Lys Asp Phe  
 260 265 270  
 Asn Pro Lys Ser Phe Val Asn Val His Asp Phe Asn Asn Phe Asp Glu  
 275 280 285  
 Ala Ile Asp Tyr Ile Arg Tyr Leu His Thr His Pro Asn Ala Tyr Leu  
 290 295 300  
 Asp Met His Tyr Glu Asn Pro Leu Asn Thr Ile Asp Gly Lys Ala Tyr  
 305 310 315 320  
 Phe Tyr Gln Asn Leu Ser Phe Lys Lys Ile Leu Asp Phe Phe Lys Thr  
 325 330 335  
 Ile Leu Glu Asn Asp Thr Ile Tyr His Asp Asn Pro Phe Ile Phe Tyr  
 340 345 350  
 Arg Asp Leu Asn Glu Pro Ser Val Ser Ile Asp Gly Leu Arg Val Asn  
 355 360 365  
 Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp  
 370 375 380  
 Asp Leu Arg Val Asn Tyr Glu Arg Leu Leu Gln Asn Ala Ser Pro Leu  
 385 390 395 400  
 Leu Glu Leu Ser Gln Asn Thr Thr Phe Lys Ile Tyr Arg Lys Ala Tyr  
 405 410 415  
 Gln Lys Ser Leu Pro Leu Leu Arg Ala Ile Arg Arg Trp Val Lys Lys  
 420 425 430

<210> 5  
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<220>  
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alpha-1,3/4-fucosyltransferase

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gaatttaaaa agaacattct ttattttatt ctcagtcagc attacacaat caccctccac 180  
caaaacccca acgaaccctc cgatctcgtc tttggcagtc ctattggatc agccagaaaa 240  
atcttatacct atcaaaaacgc aaaaagagtg ttttacacccg gtgaaaacga atcgccataat 300  
ttcaacctct ttgattacgc cataggctt gatgaatttg attttagaga tcgttattta 360  
agaatgcctt tatattatga tagactacac cataaagccg agagcgtgaa tgacaccact 420  
tcgccttaca aactcaaacc tgacagcctt tatgcttaa aaaaacccctc ccatcatttt 480  
aaagaaaaacc accccaattt atgcgcagta gtgaacaatg agagcgatcc tttgaaaaga 540  
gggttgcga gttttgtagc gagcaaccct aacgctctt aaaggaatgc tttctatgac 600  
gctttaaatt ctatagagcc agttattggg ggagggagcg tgaaaaacac ttttagctat 660  
aacattaaaa acaagagcga gttttaagc caatacaat tcaatctgtg ttttggaaaac 720  
tcacaaggct atggctatgt aactgaaaaa atcattgacg cttaactttag ccataaccatt 780  
cctattttt gggggagtcc tagcgtggca caagattta accctaagag ttttgtgaat 840  
gtttgtgatt taaaagattt tgatgaagcg attgatcatg tgcgatactt gcacacgcac 900  
ccaaacgcctt atttagacat gctttatgaa aaccctttaa acacccttga tgggaaagct 960  
tacttttacc aaaatttgag ttttaaaaaa atcctagatt tttttaaaac gatcttagaa 1020  
aacgacacga ttatcacga taaccctttt atttttatc gtgatttgaa tgagccgtt 1080  
atatctattt atgatttgag ggttaattat gatgatttga ggttaattta tgatgatttg 1140  
agggttaattt atgatgattt gagggtaat tatgatgatt tgagggtaa ttatgatgat 1200  
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gatttgaggg ttaatttgcg tgatttgagg gtttaattatg atgatttgag ggttaattat 1320  
gagcggtcttacaaaacgc ctcgcctta tttagaactct ctcaaaaacac cactttaaa 1380  
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aaaaaaatttgg qtttqtaa 1458

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<220>  
<223> *Helicobacter pylori* strain 1218 FutB  
alpha-1,3/4-fucosyltransferase

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Lys Ile Thr Ser Lys Ser Pro Pro Pro Leu Lys Ile Ala Val Ala Asn  
20 25 30

Trp Trp Gly Asp Glu Glu Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr  
35 40 45

Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His Gln Asn Pro Asn  
50 55 60

Glu Pro Ser Asp Leu Val Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys  
65 70 75 80

Glu Ser Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu  
 100 105 110

Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg  
 115 120 125

Leu His His Lys Ala Glu Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys  
 130 135 140

Leu Lys Pro Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe  
 145 150 155 160

Lys Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp  
 165 170 175

Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala  
 180 185 190

Pro Lys Arg Asn Ala Phe Tyr Asp Ala Leu Asn Ser Ile Glu Pro Val  
 195 200 205

Ile Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn  
 210 215 220

Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn  
 225 230 235 240

Ser Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe  
 245 250 255

Ser His Thr Ile Pro Ile Tyr Trp Gly Ser Pro Ser Val Ala Gln Asp  
 260 265 270

Phe Asn Pro Lys Ser Phe Val Asn Val Cys Asp Phe Lys Asp Phe Asp  
 275 280 285

Glu Ala Ile Asp His Val Arg Tyr Leu His Thr His Pro Asn Ala Tyr  
 290 295 300

Leu Asp Met Leu Tyr Glu Asn Pro Leu Asn Thr Leu Asp Gly Lys Ala  
 305 310 315 320

Tyr Phe Tyr Gln Asn Leu Ser Phe Lys Lys Ile Leu Asp Phe Phe Lys  
 325 330 335

Thr Ile Leu Glu Asn Asp Thr Ile Tyr His Asp Asn Pro Phe Ile Phe  
 340 345 350

Tyr Arg Asp Leu Asn Glu Pro Leu Ile Ser Ile Asp Asp Leu Arg Val  
 355 360 365

Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr  
 370 375 380

Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp  
 385 390 395 400

Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp Leu Arg  
 405 410 415

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Val | Asn | Tyr | Asp | Asp | Leu | Arg | Val | Asn | Cys | Asp | Asp | Leu | Arg | Val | Asn |
| 420 |     |     |     |     |     |     |     | 425 |     |     |     |     |     | 430 |     |
| Tyr | Asp | Asp | Leu | Arg | Val | Asn | Tyr | Glu | Arg | Leu | Leu | Gln | Asn | Ala | Ser |
| 435 |     |     |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |
| Pro | Leu | Leu | Glu | Leu | Ser | Gln | Asn | Thr | Thr | Phe | Lys | Ile | Tyr | Arg | Lys |
| 450 |     |     |     |     |     |     |     | 455 |     |     | 460 |     |     |     |     |
| Ala | Tyr | Gln | Lys | Ser | Leu | Pro | Leu | Leu | Arg | Ala | Ala | Arg | Lys | Leu | Ile |
| 465 |     |     |     |     |     |     | 470 |     |     | 475 |     | 480 |     |     |     |
| Lys | Lys | Leu | Gly | Leu |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     | 485 |     |     |     |     |     |     |     |     |     |     |     |

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 <213> Helicobacter pylori

<220>  
 <223> Helicobacter pylori strain 19C2 FutB  
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 gggttagaa aaaaatttat cttacatttc attttaagtc agcattacac aatcgctctc 180  
 caccgaaacc ctgataaacc tgccggacatc gttttggta acccccctgg atcagccaga 240  
 aaaaatcctat cctatcaaaa cgctaaaagg gtgtttaca ccggtgaaaa cgaagtccct 300  
 aatttcaacc tctttgatta cgccataggc tttgatgaat tggactttag agatcgttat 360  
 ttgagaatgc ctttatatta tgatagacta caccataaaag ccgagagcgt gaatgacacc 420  
 accgcaccc tcaagattaa atctgacagc ctttatgctt taaaaaagcc ctcccatcat 480  
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 gaggcttaa attctattga gccagttact gggggaggga gcgtgagaaa cacttttaggc 660  
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 aacactcaag gctatggcta tgttactgaa aaaatcattg acgcttactt cagccacacc 780  
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 <223> Helicobacter pylori strain 19C2 FutB  
 alpha-1,3/4-fucosyltransferase

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 1 5 10 15

Glu Thr Asp Tyr Lys Pro Pro Leu Asn Ile Ala Leu Ala Asn Trp Trp  
 20 25 30

Pro Leu Asp Lys Arg Glu Ser Lys Gly Phe Arg Lys Lys Phe Ile Leu  
 35 40 45

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| His | Phe | Ile | Leu | Ser | Gln | His | Tyr | Thr | Ile | Ala | Leu | His | Arg | Asn | Pro |
| 50  |     |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
| Asp | Lys | Pro | Ala | Asp | Ile | Val | Phe | Gly | Asn | Pro | Leu | Gly | Ser | Ala | Arg |
| 65  |     |     |     |     | 70  |     |     |     | 75  |     |     |     | 80  |     |     |
| Lys | Ile | Leu | Ser | Tyr | Gln | Asn | Ala | Lys | Arg | Val | Phe | Tyr | Thr | Gly | Glu |
|     |     |     |     |     | 85  |     |     |     | 90  |     |     |     | 95  |     |     |
| Asn | Glu | Val | Pro | Asn | Phe | Asn | Leu | Phe | Asp | Tyr | Ala | Ile | Gly | Phe | Asp |
|     |     |     |     |     |     |     | 100 |     | 105 |     |     |     | 110 |     |     |
| Glu | Leu | Asp | Phe | Arg | Asp | Arg | Tyr | Leu | Arg | Met | Pro | Leu | Tyr | Tyr | Asp |
|     |     |     |     |     |     |     | 115 |     | 120 |     |     |     | 125 |     |     |
| Arg | Leu | His | His | Lys | Ala | Glu | Ser | Val | Asn | Asp | Thr | Thr | Ala | Pro | Tyr |
|     |     |     |     |     |     | 130 |     | 135 |     |     | 140 |     |     |     |     |
| Lys | Ile | Lys | Ser | Asp | Ser | Leu | Tyr | Ala | Leu | Lys | Lys | Pro | Ser | His | His |
|     |     |     |     |     |     | 145 |     | 150 |     | 155 |     |     | 160 |     |     |
| Phe | Lys | Glu | Asn | His | Pro | His | Leu | Cys | Ala | Leu | Ile | Asn | Asn | Glu | Ile |
|     |     |     |     |     |     | 165 |     | 170 |     |     | 175 |     |     |     |     |
| Asp | Pro | Leu | Lys | Arg | Gly | Phe | Ala | Ser | Phe | Val | Ala | Ser | Asn | Pro | Asn |
|     |     |     |     |     |     | 180 |     | 185 |     |     | 190 |     |     |     |     |
| Ala | Pro | Ile | Arg | Asn | Ala | Phe | Tyr | Glu | Ala | Leu | Asn | Ser | Ile | Glu | Pro |
|     |     |     |     |     |     | 195 |     | 200 |     |     | 205 |     |     |     |     |
| Val | Thr | Gly | Gly | Ser | Val | Arg | Asn | Thr | Leu | Gly | Tyr | Asn | Val | Lys |     |
|     |     |     |     |     | 210 |     | 215 |     |     | 220 |     |     |     |     |     |
| Asn | Lys | Asn | Glu | Phe | Leu | Ser | Gln | Tyr | Lys | Phe | Asn | Leu | Cys | Phe | Glu |
|     |     |     |     |     |     | 225 |     | 230 |     | 235 |     |     |     | 240 |     |
| Asn | Thr | Gln | Gly | Tyr | Gly | Tyr | Val | Thr | Glu | Lys | Ile | Ile | Asp | Ala | Tyr |
|     |     |     |     |     |     | 245 |     | 250 |     |     | 255 |     |     |     |     |
| Phe | Ser | His | Thr | Ile | Pro | Ile | Tyr | Trp | Gly | Gly | Val | Pro | Ser | Val | Ala |
|     |     |     |     |     |     | 260 |     | 265 |     |     | 270 |     |     |     |     |
| Lys | Asp | Phe | Asn | Pro |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     | 275 |     |     |     |     |     |     |     |     |     |     |     |

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<212> DNA  
<213> Helicobacter pylori

<220>  
<223> Helicobacter pylori strain 915 Futa  
alpha-1,3/4-fucosyltransferase

<400> 9  
atggcctcta aatctccccc cctaaaaatc gctgtggcga attgggtgggg agatgaagaa 60  
ataaaaaaat ttaaaaaagag cgtttttat tttatcctaa gccagcatta cacaatcact 120  
ttacaccgaa accctgataa acctgcgac atcgttttg gtaaccctt tggatcagcc 180  
agaaaaatct tatcctatca aaacgcaaaa agggtgtttt acaccggta aaatgaagtc 240  
cctaacttca accttttga ttacgccata ggcttt 276

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<210> 10
<211> 92
<212> PRT
<213> Helicobacter pylori

<220>
<223> Helicobacter pylori strain 915 Futa
      alpha-1,3/4-fucosyltransferase

<400> 10
Met Ala Ser Lys Ser Pro Pro Leu Lys Ile Ala Val Ala Asn Trp Trp
  1           5           10          15

Gly Asp Glu Glu Ile Lys Lys Phe Lys Ser Val Leu Tyr Phe Ile
  20          25          30

Leu Ser Gln His Tyr Thr Ile Thr Leu His Arg Asn Pro Asp Lys Pro
  35          40          45

Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile Leu
  50          55          60

Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu Val
  65          70          75          80

Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe
  85          90

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<210> 11
<211> 1278
<212> DNA
<213> Helicobacter pylori

<220>
<223> Helicobacter pylori strain 26695 Futa
      alpha-1,3/4-fucosyltransferase

<400> 11
atgttccaaac ccctattaga cgcctttata gaaagcgctt ccattgaaaa aatggcctct 60
aaatctcccc cccccccccc aaaaatcgct gtggcgaatt ggtggggaga tgaagaaatt 120
aaagaattta aaaagagcgt tctttattt atcctaagcc aacgctacgc aatcaccctc 180
caccaaaacc ccaatgaatt ttcagatcta gtttttagca atcctttgg agcggctaga 240
aagattttat cttatcaaaa cactaaacga gtgtttaca ccgtgaaaa cgaatcacct 300
aatttcaacc tctttgatta cgccataggc tttgatgaat tggattttaa tgatcgttat 360
ttgagaatgc ctttgtatta tgcccattt cactataaag ccgagcttgc taatgacacc 420
actgcgcctt acaaactcaa agacaacagc ctttatgctt taaaaaaacc ctctcatcat 480
tttaaagaaa accaccctaa tttgtgcga gtagtgaatg atgagagcga tcttttaaaa 540
agagggtttt ccagtttgc agcgagcaac gctaacgctc ctatgagggaa cgctttttat 600
gacgctctaa attccataga gccagttact gggggaggaa gtgtgagaaa cacttttaggc 660
tataaggtt gaaacaaaag cgagttttt aagcaataca agttcaatct ctgttttggaa 720
aactcgcaag gttatggcta tptaaccgaa aaaatccttgc atgcgtattt tagccataacc 780
attccttattt attgggggag tcccagcgtg gcgaaagatt ttaaccctaa aagttttgt 840
aatgtgcattt atttcaacaa ctttgatgaa gcgattgatt atatcaaata cctgcacacg 900
cacccaaacg cttattttaga catgctctat gaaaaccctt taaacaccct tgatggggaaa 960
gtttactttt accaagattt gagttttaaa aaaatccttag atttttttaa aacgattttt 1020
gaaaacgata cgatttatca caaattctca acatcttca tgtgggagta cgatctgcat 1080
aagccgttag tatccattga tgatttgagg gttaattatg atgatttgag ggtaatttat 1140
gaccggcttt tacaaaacgc ttgccttta tttagaactct ctcaaaacac cacttttaaa 1200
atctatcgca aagcttataca aaaatccttgc ctttggatgc gcgccgtgag aaagttgggt 1260
aaaaaaattgg gtttgtaa 1278

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<210> 12
<211> 425
<212> PRT
<213> Helicobacter pylori

<220>
<223> Helicobacter pylori strain 26695 Futa
      alpha-1,3/4-fucosyltransferase

<400> 12
Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala Ser Ile Glu
  1           5           10          15

Lys Met Ala Ser Lys Ser Pro Pro Pro Pro Leu Lys Ile Ala Val Ala
  20          25          30

Asn Trp Trp Gly Asp Glu Glu Ile Lys Glu Phe Lys Lys Ser Val Leu
  35          40          45

Tyr Phe Ile Leu Ser Gln Arg Tyr Ala Ile Thr Leu His Gln Asn Pro
  50          55          60

Asn Glu Phe Ser Asp Leu Val Phe Ser Asn Pro Leu Gly Ala Ala Arg
  65          70          75          80

Lys Ile Leu Ser Tyr Gln Asn Thr Lys Arg Val Phe Tyr Thr Gly Glu
  85          90          95

Asn Glu Ser Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp
  100         105         110

Glu Leu Asp Phe Asn Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Ala
  115         120         125

His Leu His Tyr Lys Ala Glu Leu Val Asn Asp Thr Thr Ala Pro Tyr
  130         135         140

Lys Leu Lys Asp Asn Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His
  145         150         155         160

Phe Lys Glu Asn His Pro Asn Leu Cys Ala Val Val Asn Asp Glu Ser
  165         170         175

Asp Leu Leu Lys Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Ala Asn
  180         185         190

Ala Pro Met Arg Asn Ala Phe Tyr Asp Ala Leu Asn Ser Ile Glu Pro
  195         200         205

Val Thr Gly Gly Ser Val Arg Asn Thr Leu Gly Tyr Lys Val Gly
  210         215         220

Asn Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu
  225         230         235         240

Asn Ser Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile Leu Asp Ala Tyr
  245         250         255

Phe Ser His Thr Ile Pro Ile Tyr Trp Gly Ser Pro Ser Val Ala Lys
  260         265         270

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asp | Phe | Asn | Pro | Lys | Ser | Phe | Val | Asn | Val | His | Asp | Phe | Asn | Asn | Phe |
| 275 |     |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |     |
| Asp | Glu | Ala | Ile | Asp | Tyr | Ile | Lys | Tyr | Leu | His | Thr | His | Pro | Asn | Ala |
| 290 |     |     |     |     | 295 |     |     |     | 300 |     |     |     |     |     |     |
| Tyr | Leu | Asp | Met | Leu | Tyr | Glu | Asn | Pro | Leu | Asn | Thr | Leu | Asp | Gly | Lys |
| 305 |     |     |     |     | 310 |     |     |     | 315 |     |     | 320 |     |     |     |
| Ala | Tyr | Phe | Tyr | Gln | Asp | Leu | Ser | Phe | Lys | Lys | Ile | Leu | Asp | Phe | Phe |
|     |     | 325 |     |     |     |     |     | 330 |     |     |     |     | 335 |     |     |
| Lys | Thr | Ile | Leu | Glu | Asn | Asp | Thr | Ile | Tyr | His | Lys | Phe | Ser | Thr | Ser |
|     |     |     |     |     | 340 |     |     | 345 |     |     |     | 350 |     |     |     |
| Phe | Met | Trp | Glu | Tyr | Asp | Leu | His | Lys | Pro | Leu | Val | Ser | Ile | Asp | Asp |
|     |     | 355 |     |     |     | 360 |     |     |     |     |     | 365 |     |     |     |
| Leu | Arg | Val | Asn | Tyr | Asp | Asp | Leu | Arg | Val | Asn | Tyr | Asp | Arg | Leu | Leu |
|     |     | 370 |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |
| Gln | Asn | Ala | Ser | Pro | Leu | Leu | Glu | Leu | Ser | Gln | Asn | Thr | Thr | Phe | Lys |
|     |     | 385 |     |     |     | 390 |     |     |     | 395 |     |     |     | 400 |     |
| Ile | Tyr | Arg | Lys | Ala | Tyr | Gln | Lys | Ser | Leu | Pro | Leu | Leu | Arg | Ala | Val |
|     |     |     |     |     | 405 |     |     |     | 410 |     |     |     | 415 |     |     |
| Arg | Lys | Leu | Val | Lys | Lys | Leu | Gly | Leu |     |     |     |     |     |     |     |
|     |     |     |     | 420 |     |     |     | 425 |     |     |     |     |     |     |     |

<210> 13

<211> 45

<212> DNA

<213> Helicobacter pylori

<220>

<223> Helicobacter pylori strain 19C2 FutA  
alpha-1,3/4-fucosyltransferase

<400> 13

atgttccaac ccttactaga cgcccttata gaaagtgctc caatt 45

<210> 14

<211> 15

<212> PRT

<213> Helicobacter pylori

<220>

<223> Helicobacter pylori strain 19C2 FutA  
alpha-1,3/4-fucosyltransferase

<400> 14

Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala Pro Ile  
1 5 10 15

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<210> 15
<211> 283
<212> PRT
<213> Helicobacter pylori

<220>
<223> Helicobacter pylori strain 1182 FutB
      alpha-1,3/4-fucosyltransferase amino acids 23-305,
      conserved fucosyltransferase catalytic domain

<400> 15
Pro Pro Pro Leu Lys Ile Ala Val Ala Asn Trp Trp Gly Asp Glu Glu
  1           5           10          15

Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr Phe Ile Leu Ser Gln His
  20          25          30

Tyr Thr Ile Thr Leu His Gln Asn Pro Asn Glu Pro Ser Asp Leu Val
  35          40          45

Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys Ile Leu Ser Tyr Gln Asn
  50          55          60

Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu Ser Pro Asn Phe Asn
  65          70          75          80

Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu Asp Phe Arg Asp Arg
  85          90          95

Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg Leu His His Lys Ala Glu
 100         105         110

Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu Lys Pro Asp Ser Leu
 115         120         125

Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys Glu Asn His Pro Asn
 130         135         140

Leu Cys Ala Val Val Asn Asn Glu Ser Asp Pro Leu Lys Arg Gly Phe
 145         150         155         160

Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro Lys Arg Asn Ala Phe
 165         170         175

Tyr Asp Val Leu Asn Ser Ile Glu Pro Val Ile Gly Gly Ser Val
 180         185         190

Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn Lys Ser Glu Phe Leu Ser
 195         200         205

Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Ser Gln Gly Tyr Gly Tyr
 210         215         220

Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe Ser His Thr Ile Pro Ile
 225         230         235         240

Tyr Trp Gly Ser Pro Ser Val Ala Gln Asp Phe Asn Pro Lys Ser Phe
 245         250         255

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Val Asn Val Cys Asp Phe Lys Asp Phe Asp Glu Ala Ile Asp His Val  
260 265 270

Arg Tyr Leu His Thr His Pro Asn Ala Tyr Leu  
275 280

<210> 16  
<211> 291  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:pfam00852,  
Glyco\_transf\_10 consensus sequence from  
glycosyltransferase family 10 fucosyltransferase  
family

<400> 16  
Thr Val Pro Leu Leu Leu Ala Ile Tyr Thr Trp Trp Ser Leu Ile Glu  
1 5 10 15

Tyr Lys Glu Trp Lys Lys Ser Pro Ile Tyr Phe Ile Gly Ser Gln Ala  
20 25 30

Pro Gln Pro Pro Leu Arg Ile Leu Leu Trp Thr Trp Pro Phe Asn Gly  
35 40 45

Asn Pro Leu Ala Leu Ser Asp Cys Pro Leu Ser Tyr Gln Asn Thr Ala  
50 55 60

Arg Cys Arg Leu Thr Ala Asn Arg Ser Pro Leu Glu Ser Ala Asp Ala  
65 70 75 80

Val Leu Phe His His Arg Asp Leu Ser Lys Gly Phe Pro Asp Leu Pro  
85 90 95

Pro Ser Pro Arg Pro Pro Gly Gln Pro Trp Val Trp Ala Ser Met Glu  
100 105 110

Ser Pro Ser Asn Ser Gly Leu Asn Asp Leu Arg Asp Gly Tyr Phe Asn  
115 120 125

Trp Thr Leu Ser Tyr Arg Ala Asp Ser Asp Ala Phe His Pro Tyr Gly  
130 135 140

Tyr Leu Glu Pro Arg Leu Ser Gln Val Val Asn Ala Pro Leu Leu Ser  
145 150 155 160

Ala Lys Arg Lys Gly Ala Ala Trp Val Val Ser Asn Cys Asn Thr Arg  
165 170 175

Ser Lys Arg Glu Arg Phe Tyr Lys Gln Leu Asn Lys His Leu Gln Val  
180 185 190

Asp Val Gly Gly Arg Val Ala Asn Pro Leu Pro Leu Lys Val Gly Cys  
195 200 205

Leu Val Glu Thr Leu Ser Gln Tyr Lys Phe Tyr Leu Ala Phe Glu Asn  
210 215 220

Ser Gln His Tyr Asp Tyr Val Thr Glu Lys Leu Trp Lys Asn Ala Leu  
 225 230 235 240  
 Gln Ala Gly Thr Ile Pro Val Val Leu Gly Pro Arg Ala Val Tyr Glu  
 245 250 255  
 Asp Phe Val Pro Pro Lys Ser Phe Ile His Val Asp Asp Phe Lys Ser  
 260 265 270  
 Pro Lys Glu Leu Ala Asp Tyr Leu Leu Tyr Leu Asp Thr Asn Pro Thr  
 275 280 285  
 Ala Tyr Ser  
 290

<210> 17  
 <211> 391  
 <212> PRT  
 <213> Helicobacter pylori

<220>  
 <223> Helicobacter pylori strain 1111 Futa  
 alpha-1,3/4-fucosyltransferase amino acids 27-417,  
 conserved fucosyltransferase catalytic domain

<400> 17  
 Ile Ala Val Ala Asn Trp Trp Gly Asp Glu Glu Ile Lys Lys Phe Lys  
 1 5 10 15  
 Lys Ser Val Leu Tyr Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu  
 20 25 30  
 His Arg Asn Pro Asp Lys Pro Ala Asp Ile Val Phe Gly Asn Pro Leu  
 35 40 45  
 Gly Ser Ala Arg Lys Ile Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe  
 50 55 60  
 Tyr Thr Gly Glu Asn Glu Val Pro Asn Phe Asn Leu Phe Asp Tyr Ala  
 65 70 75 80  
 Ile Gly Phe Asp Glu Leu Asp Phe Arg Asp Arg Tyr Leu Arg Met Pro  
 85 90 95  
 Leu Tyr Tyr Ala Tyr Leu His Tyr Lys Ala Glu Leu Val Asn Asp Thr  
 100 105 110  
 Thr Ser Pro Tyr Lys Leu Gln Pro Asp Ser Leu Tyr Ala Leu Lys Lys  
 115 120 125  
 Pro Ser His His Phe Lys Glu Asn His Pro Asn Leu Cys Ala Val Val  
 130 135 140  
 Asn Asn Glu Ser Asp Pro Leu Lys Arg Gly Phe Ala Ser Phe Val Ala  
 145 150 155 160  
 Ser Asn Pro Asn Ala Pro Arg Arg Asn Ala Phe Tyr Glu Ala Leu Asn  
 165 170 175

Ala Ile Glu Pro Val Ala Gly Gly Ser Val Lys Asn Thr Leu Gly  
 180 185 190  
 Tyr Asn Val Lys Asn Lys Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn  
 195 200 205  
 Leu Cys Phe Glu Asn Thr Gln Gly Tyr Gly Tyr Val Thr Glu Lys Ile  
 210 215 220  
 Ile Asp Ala Tyr Phe Ser His Thr Ile Pro Ile Tyr Trp Gly Ser Pro  
 225 230 235 240  
 Ser Val Ala Lys Asp Phe Asn Pro Lys Ser Phe Val Asn Val His Asp  
 245 250 255  
 Phe Asn Asn Phe Asp Glu Ala Ile Asp Tyr Ile Arg Tyr Leu His Thr  
 260 265 270  
 His Pro Asn Ala Tyr Leu Asp Met His Tyr Glu Asn Pro Leu Asn Thr  
 275 280 285  
 Ile Asp Gly Lys Ala Tyr Phe Tyr Gln Asn Leu Ser Phe Lys Lys Ile  
 290 295 300  
 Leu Asp Phe Phe Lys Thr Ile Leu Glu Asn Asp Thr Ile Tyr His Asp  
 305 310 315 320  
 Asn Pro Phe Ile Phe Tyr Arg Asp Leu Asn Glu Pro Ser Val Ser Ile  
 325 330 335  
 Asp Gly Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Asp Asp  
 340 345 350  
 Leu Arg Val Asn Tyr Asp Asp Leu Arg Val Asn Tyr Glu Arg Leu Leu  
 355 360 365  
 Gln Asn Ala Ser Pro Leu Leu Glu Leu Ser Gln Asn Thr Thr Phe Lys  
 370 375 380  
 Ile Tyr Arg Lys Ala Tyr Gln  
 385 390

<210> 18  
 <211> 336  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence:pfam00852,  
 Glyco\_transf\_10 consensus sequence from  
 glycosyltransferase family 10 fucosyltransferase  
 family

<400> 18  
 Leu Ala Ile Tyr Thr Trp Trp Ser Leu Ile Glu Tyr Lys Glu Trp Lys  
 1 5 10 15  
 Lys Ser Pro Ile Tyr Phe Ile Gly Ser Gln Ala Pro Gln Pro Pro Leu  
 20 25 30

Arg Ile Leu Leu Trp Thr Trp Pro Phe Asn Gly Asn Pro Leu Ala Leu  
 35 40 45

Ser Asp Cys Pro Leu Ser Tyr Gln Asn Thr Ala Arg Cys Arg Leu Thr  
 50 55 60

Ala Asn Arg Ser Pro Leu Glu Ser Ala Asp Ala Val Leu Phe His His  
 65 70 75 80

Arg Asp Leu Ser Lys Gly Phe Pro Asp Leu Pro Pro Ser Pro Arg Pro  
 85 90 95

Pro Gly Gln Pro Trp Val Trp Ala Ser Met Glu Ser Pro Ser Asn Ser  
 100 105 110

Gly Leu Asn Asp Leu Arg Asp Gly Tyr Phe Asn Trp Thr Leu Ser Tyr  
 115 120 125

Arg Ala Asp Ser Asp Ala Phe His Pro Tyr Gly Tyr Leu Glu Pro Arg  
 130 135 140

Leu Ser Gln Val Val Asn Ala Pro Leu Leu Ser Ala Lys Arg Lys Gly  
 145 150 155 160

Ala Ala Trp Val Val Ser Asn Cys Asn Thr Arg Ser Lys Arg Glu Arg  
 165 170 175

Phe Tyr Lys Gln Leu Asn Lys His Leu Gln Val Asp Val Gly Gly Arg  
 180 185 190

Val Ala Asn Pro Leu Pro Leu Lys Val Gly Cys Leu Val Glu Thr Leu  
 195 200 205

Ser Gln Tyr Lys Phe Tyr Leu Ala Phe Glu Asn Ser Gln His Tyr Asp  
 210 215 220

Tyr Val Thr Glu Lys Leu Trp Lys Asn Ala Leu Gln Ala Gly Thr Ile  
 225 230 235 240

Pro Val Val Leu Gly Pro Arg Ala Val Tyr Glu Asp Phe Val Pro Pro  
 245 250 255

Lys Ser Phe Ile His Val Asp Asp Phe Lys Ser Pro Lys Glu Leu Ala  
 260 265 270

Asp Tyr Leu Leu Tyr Leu Asp Thr Asn Pro Thr Ala Tyr Ser Glu Tyr  
 275 280 285

Phe Glu Trp Arg Tyr Asp Leu Arg Val Arg Leu Phe Ser Trp Asp Ala  
 290 295 300

Leu Arg Tyr Asp Glu Gly Phe Cys Arg Val Cys Arg Leu Leu Gln Asn  
 305 310 315 320

Ala Pro Asp Arg Tyr Lys Thr Tyr Pro Asn Ile Ala Lys Trp Phe Gln  
 325 330 335

<210> 19  
 <211> 377  
 <212> PRT  
 <213> Helicobacter pylori

<220>  
 <223> Helicobacter pylori strain 1218 FutB  
 alpha-1,3/4-fucosyltransferase amino acids 23-399,  
 conserved fucosyltransferase catalytic domain

<400> 19  
 Pro Pro Pro Leu Lys Ile Ala Val Ala Asn Trp Trp Gly Asp Glu Glu  
 1 5 10 15

Val Glu Glu Phe Lys Lys Asn Ile Leu Tyr Phe Ile Leu Ser Gln His  
 20 25 30

Tyr Thr Ile Thr Leu His Gln Asn Pro Asn Glu Pro Ser Asp Leu Val  
 35 40 45

Phe Gly Ser Pro Ile Gly Ser Ala Arg Lys Ile Leu Ser Tyr Gln Asn  
 50 55 60

Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Ser Pro Asn Phe Asn  
 65 70 75 80

Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu Asp Phe Arg Asp Arg  
 85 90 95

Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg Leu His His Lys Ala Glu  
 100 105 110

Ser Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu Lys Pro Asp Ser Leu  
 115 120 125

Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys Glu Asn His Pro Asn  
 130 135 140

Leu Cys Ala Val Val Asn Asn Glu Ser Asp Pro Leu Lys Arg Gly Phe  
 145 150 155 160

Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro Lys Arg Asn Ala Phe  
 165 170 175

Tyr Asp Ala Leu Asn Ser Ile Glu Pro Val Ile Gly Gly Ser Val  
 180 185 190

Lys Asn Thr Leu Gly Tyr Asn Ile Lys Asn Lys Ser Glu Phe Leu Ser  
 195 200 205

Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Ser Gln Gly Tyr Gly Tyr  
 210 215 220

Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe Ser His Thr Ile Pro Ile  
 225 230 235 240

Tyr Trp Gly Ser Pro Ser Val Ala Gln Asp Phe Asn Pro Lys Ser Phe  
 245 250 255

Val Asn Val Cys Asp Phe Lys Asp Phe Asp Glu Ala Ile Asp His Val  
 260 265 270

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Arg | Tyr | Leu | His | Thr | His | Pro | Asn | Ala | Tyr | Leu | Asp | Met | Leu | Tyr | Glu |
| 275 |     |     |     |     |     | 280 |     |     |     |     |     | 285 |     |     |     |
| Asn | Pro | Leu | Asn | Thr | Leu | Asp | Gly | Lys | Ala | Tyr | Phe | Tyr | Gln | Asn | Leu |
| 290 |     |     |     |     |     | 295 |     |     |     |     |     | 300 |     |     |     |
| Ser | Phe | Lys | Lys | Ile | Leu | Asp | Phe | Phe | Lys | Thr | Ile | Leu | Glu | Asn | Asp |
| 305 |     |     |     |     |     | 310 |     |     |     |     |     | 315 |     |     | 320 |
| Thr | Ile | Tyr | His | Asp | Asn | Pro | Phe | Ile | Phe | Tyr | Arg | Asp | Leu | Asn | Glu |
|     |     |     |     |     |     | 325 |     |     |     |     | 330 |     |     |     | 335 |
| Pro | Leu | Ile | Ser | Ile | Asp | Asp | Leu | Arg | Val | Asn | Tyr | Asp | Asp | Leu | Arg |
|     |     |     |     |     |     | 340 |     |     |     |     | 345 |     |     |     | 350 |
| Val | Asn | Tyr | Asp | Asp | Leu | Arg | Val | Asn | Tyr | Asp | Asp | Leu | Arg | Val | Asn |
|     |     |     |     |     |     | 355 |     |     |     |     | 360 |     |     |     | 365 |
| Tyr | Asp | Asp | Leu | Arg | Val | Asn | Tyr | Asp |     |     |     |     |     |     |     |
|     |     |     |     |     |     | 370 |     |     |     |     | 375 |     |     |     |     |

<210> 20  
 <211> 341  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence:pfam00852,  
 Glyco\_transf\_10 consensus sequence from  
 glycosyltransferase family 10 fucosyltransferase  
 family

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Thr | Val | Pro | Leu | Leu | Leu | Ala | Ile | Tyr | Thr | Trp | Trp | Ser | Leu | Ile | Glu |
| 1   |     |     |     |     |     |     |     |     | 10  |     |     |     |     | 15  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Tyr | Lys | Glu | Trp | Lys | Lys | Ser | Pro | Ile | Tyr | Phe | Ile | Gly | Ser | Gln | Ala |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     | 30  |     |
| 20  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 25  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pro | Gln | Pro | Pro | Leu | Arg | Ile | Leu | Leu | Trp | Thr | Trp | Pro | Phe | Asn | Gly |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 35  |     |     |     |     |     |     |     |     |     |     |     |     | 45  |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asn | Pro | Leu | Ala | Leu | Ser | Asp | Cys | Pro | Leu | Ser | Tyr | Gln | Asn | Thr | Ala |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 50  |     |     |     |     |     |     |     |     |     |     |     | 60  |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Arg | Cys | Arg | Leu | Thr | Ala | Asn | Arg | Ser | Pro | Leu | Glu | Ser | Ala | Asp | Ala |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 65  |     |     |     |     |     |     |     |     |     |     | 75  |     |     |     | 80  |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Val | Leu | Phe | His | His | Arg | Asp | Leu | Ser | Lys | Gly | Phe | Pro | Asp | Leu | Pro |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 85  |     |     |     |     |     |     |     |     |     |     | 90  |     |     |     | 95  |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pro | Ser | Pro | Arg | Pro | Pro | Gly | Gln | Pro | Trp | Val | Trp | Ala | Ser | Met | Glu |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 100 |     |     |     |     |     |     |     |     |     |     |     |     | 110 |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ser | Pro | Ser | Asn | Ser | Gly | Leu | Asn | Asp | Leu | Arg | Asp | Gly | Tyr | Phe | Asn |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 115 |     |     |     |     |     |     |     |     |     |     |     | 120 |     |     | 125 |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Trp | Thr | Leu | Ser | Tyr | Arg | Ala | Asp | Ser | Asp | Ala | Phe | His | Pro | Tyr | Gly |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 130 |     |     |     |     |     |     |     |     |     |     |     | 135 |     |     | 140 |

Tyr Leu Glu Pro Arg Leu Ser Gln Val Val Asn Ala Pro Leu Leu Ser  
 145 150 155 160  
 Ala Lys Arg Lys Gly Ala Ala Trp Val Val Ser Asn Cys Asn Thr Arg  
 165 170 175  
 Ser Lys Arg Glu Arg Phe Tyr Lys Gln Leu Asn Lys His Leu Gln Val  
 180 185 190  
 Asp Val Gly Gly Arg Val Ala Asn Pro Leu Pro Leu Lys Val Gly Cys  
 195 200 205  
 Leu Val Glu Thr Leu Ser Gln Tyr Lys Phe Tyr Leu Ala Phe Glu Asn  
 210 215 220  
 Ser Gln His Tyr Asp Tyr Val Thr Glu Lys Leu Trp Lys Asn Ala Leu  
 225 230 235 240  
 Gln Ala Gly Thr Ile Pro Val Val Leu Gly Pro Arg Ala Val Tyr Glu  
 245 250 255  
 Asp Phe Val Pro Pro Lys Ser Phe Ile His Val Asp Asp Phe Lys Ser  
 260 265 270  
 Pro Lys Glu Leu Ala Asp Tyr Leu Leu Tyr Leu Asp Thr Asn Pro Thr  
 275 280 285  
 Ala Tyr Ser Glu Tyr Phe Glu Trp Arg Tyr Asp Leu Arg Val Arg Leu  
 290 295 300  
 Phe Ser Trp Asp Ala Leu Arg Tyr Asp Glu Gly Phe Cys Arg Val Cys  
 305 310 315 320  
 Arg Leu Leu Gln Asn Ala Pro Asp Arg Tyr Lys Thr Tyr Pro Asn Ile  
 325 330 335  
 Ala Lys Trp Phe Gln  
 340

<210> 21  
 <211> 256  
 <212> PRT  
 <213> Helicobacter pylori

<220>  
 <223> Helicobacter pylori strain 19C2 FutB  
 alpha-1,3/4-fucosyltransferase amino acids 23-377,  
 conserved fucosyltransferase catalytic domain

<400> 21  
 Pro Pro Leu Asn Ile Ala Leu Ala Asn Trp Trp Pro Leu Asp Lys Arg  
 1 5 10 15

Glu Ser Lys Gly Phe Arg Lys Lys Phe Ile Leu His Phe Ile Leu Ser  
 20 25 30

Gln His Tyr Thr Ile Ala Leu His Arg Asn Pro Asp Lys Pro Ala Asp  
 35 40 45

Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile Leu Ser Tyr  
 50 55 60

Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu Val Pro Asn  
 65 70 75 80

Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu Asp Phe Arg  
 85 90 95

Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr Asp Arg Leu His His Lys  
 100 105 110

Ala Glu Ser Val Asn Asp Thr Thr Ala Pro Tyr Lys Ile Lys Ser Asp  
 115 120 125

Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys Glu Asn His  
 130 135 140

Pro His Leu Cys Ala Leu Ile Asn Asn Glu Ile Asp Pro Leu Lys Arg  
 145 150 155 160

Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro Ile Arg Asn  
 165 170 175

Ala Phe Tyr Glu Ala Leu Asn Ser Ile Glu Pro Val Thr Gly Gly Gly  
 180 185 190

Ser Val Arg Asn Thr Leu Gly Tyr Asn Val Lys Asn Lys Asn Glu Phe  
 195 200 205

Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Thr Gln Gly Tyr  
 210 215 220

Gly Tyr Val Thr Glu Lys Ile Ile Asp Ala Tyr Phe Ser His Thr Ile  
 225 230 235 240

Pro Ile Tyr Trp Gly Gly Val Pro Ser Val Ala Lys Asp Phe Asn Pro  
 245 250 255

<210> 22  
 <211> 259  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence:pfam00852,  
 Glyco\_transf\_10 consensus sequence from  
 glycosyltransferase family 10 fucosyltransferase  
 family

<400> 22  
 Val Pro Leu Leu Leu Ala Ile Tyr Thr Trp Trp Ser Leu Ile Glu Tyr  
 1 5 10 15

Lys Glu Trp Lys Lys Ser Pro Ile Tyr Phe Ile Gly Ser Gln Ala Pro  
 20 25 30

Gln Pro Pro Leu Arg Ile Leu Leu Trp Thr Trp Pro Phe Asn Gly Asn  
 35 40 45

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pro | Leu | Ala | Leu | Ser | Asp | Cys | Pro | Leu | Ser | Tyr | Gln | Asn | Thr | Ala | Arg |
| 50  |     |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
| Cys | Arg | Leu | Thr | Ala | Asn | Arg | Ser | Pro | Leu | Glu | Ser | Ala | Asp | Ala | Val |
| 65  |     |     |     |     |     | 70  |     |     |     | 75  |     |     | 80  |     |     |
| Leu | Phe | His | His | Arg | Asp | Leu | Ser | Lys | Gly | Phe | Pro | Asp | Leu | Pro | Pro |
|     | 85  |     |     |     |     |     |     | 90  |     |     | 95  |     |     |     |     |
| Ser | Pro | Arg | Pro | Pro | Gly | Gln | Pro | Trp | Val | Trp | Ala | Ser | Met | Glu | Ser |
|     | 100 |     |     |     |     |     |     | 105 |     |     | 110 |     |     |     |     |
| Pro | Ser | Asn | Ser | Gly | Leu | Asn | Asp | Leu | Arg | Asp | Gly | Tyr | Phe | Asn | Trp |
|     | 115 |     |     |     |     |     | 120 |     |     |     | 125 |     |     |     |     |
| Thr | Leu | Ser | Tyr | Arg | Ala | Asp | Ser | Asp | Ala | Phe | His | Pro | Tyr | Gly | Tyr |
|     | 130 |     |     |     |     |     | 135 |     |     |     | 140 |     |     |     |     |
| Leu | Glu | Pro | Arg | Leu | Ser | Gln | Val | Val | Asn | Ala | Pro | Leu | Leu | Ser | Ala |
|     | 145 |     |     |     |     |     | 150 |     |     | 155 |     |     | 160 |     |     |
| Lys | Arg | Lys | Gly | Ala | Ala | Trp | Val | Val | Ser | Asn | Cys | Asn | Thr | Arg | Ser |
|     | 165 |     |     |     |     |     | 170 |     |     |     | 175 |     |     |     |     |
| Lys | Arg | Glu | Arg | Phe | Tyr | Lys | Gln | Leu | Asn | Lys | His | Leu | Gln | Val | Asp |
|     | 180 |     |     |     |     |     | 185 |     |     |     | 190 |     |     |     |     |
| Val | Gly | Gly | Arg | Val | Ala | Asn | Pro | Leu | Pro | Leu | Lys | Val | Gly | Cys | Leu |
|     | 195 |     |     |     |     |     | 200 |     |     |     | 205 |     |     |     |     |
| Val | Glu | Thr | Leu | Ser | Gln | Tyr | Lys | Phe | Tyr | Leu | Ala | Phe | Glu | Asn | Ser |
|     | 210 |     |     |     |     |     | 215 |     |     |     | 220 |     |     |     |     |
| Gln | His | Tyr | Asp | Tyr | Val | Thr | Glu | Lys | Leu | Trp | Lys | Asn | Ala | Leu | Gln |
|     | 225 |     |     |     |     |     | 230 |     |     | 235 |     |     | 240 |     |     |
| Ala | Gly | Thr | Ile | Pro | Val | Val | Leu | Gly | Pro | Arg | Ala | Val | Tyr | Glu | Asp |
|     | 245 |     |     |     |     |     | 250 |     |     |     | 255 |     |     |     |     |
| Phe | Val | Pro |     |     |     |     |     |     |     |     |     |     |     |     |     |

|       |                                |        |        |      |      |     |     |     |     |     |     |     |     |     |     |
|-------|--------------------------------|--------|--------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <210> | 23                             |        |        |      |      |     |     |     |     |     |     |     |     |     |     |
| <211> | 245                            |        |        |      |      |     |     |     |     |     |     |     |     |     |     |
| <212> | PRT                            |        |        |      |      |     |     |     |     |     |     |     |     |     |     |
| <213> | Helicobacter                   | pylori |        |      |      |     |     |     |     |     |     |     |     |     |     |
| <220> |                                |        |        |      |      |     |     |     |     |     |     |     |     |     |     |
| <223> | Helicobacter                   | pylori | strain | 1111 | FutA |     |     |     |     |     |     |     |     |     |     |
|       | alpha-1,3/4-fucosyltransferase |        |        |      |      |     |     |     |     |     |     |     |     |     |     |
| <400> | 23                             |        |        |      |      |     |     |     |     |     |     |     |     |     |     |
| Met   | Phe                            | Gln    | Pro    | Leu  | Leu  | Asp | Ala | Phe | Ile | Glu | Ser | Ala | Pro | Leu | Lys |
| 1     |                                |        |        |      |      | 5   |     |     |     | 10  |     |     |     | 15  |     |
| Lys   | Trp                            | Pro    | Leu    | Asn  | Leu  | Pro | Pro | Leu | Lys | Ile | Ala | Val | Ala | Asn | Trp |
|       |                                |        |        |      |      |     |     |     | 25  |     |     |     | 30  |     |     |
| Trp   | Gly                            | Asp    | Glu    | Glu  | Ile  | Lys | Lys | Phe | Lys | Lys | Ser | Val | Leu | Tyr | Phe |
|       |                                |        |        |      |      |     |     |     | 40  |     |     |     | 45  |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ile | Leu | Ser | Gln | His | Tyr | Thr | Ile | Thr | Leu | His | Arg | Asn | Pro | Asp | Lys |
| 50  |     |     |     |     |     |     | 55  |     |     | 60  |     |     |     |     |     |
| Pro | Ala | Asp | Ile | Val | Phe | Gly | Asn | Pro | Leu | Gly | Ser | Ala | Arg | Lys | Ile |
| 65  |     |     |     |     | 70  |     |     |     | 75  |     |     |     | 80  |     |     |
| Leu | Ser | Tyr | Gln | Asn | Ala | Lys | Arg | Val | Phe | Tyr | Thr | Gly | Glu | Asn | Glu |
|     |     |     |     |     |     | 85  |     |     | 90  |     |     |     | 95  |     |     |
| Val | Pro | Asn | Phe | Asn | Leu | Phe | Asp | Tyr | Ala | Ile | Gly | Phe | Asp | Glu | Leu |
|     |     |     |     |     |     | 100 |     | 105 |     |     |     | 110 |     |     |     |
| Asp | Phe | Arg | Asp | Arg | Tyr | Leu | Arg | Met | Pro | Leu | Tyr | Tyr | Ala | Tyr | Leu |
|     |     |     |     |     |     | 115 |     | 120 |     |     |     | 125 |     |     |     |
| His | Tyr | Lys | Ala | Glu | Leu | Val | Asn | Asp | Thr | Thr | Ser | Pro | Tyr | Lys | Leu |
|     |     |     |     |     |     | 130 |     | 135 |     |     | 140 |     |     |     |     |
| Gln | Pro | Asp | Ser | Leu | Tyr | Ala | Leu | Lys | Lys | Pro | Ser | His | His | Phe | Lys |
|     |     |     |     |     |     | 145 |     | 150 |     | 155 |     |     |     | 160 |     |
| Glu | Asn | His | Pro | Asn | Leu | Cys | Ala | Val | Val | Asn | Asn | Glu | Ser | Asp | Pro |
|     |     |     |     |     |     | 165 |     |     | 170 |     |     |     | 175 |     |     |
| Leu | Lys | Arg | Gly | Phe | Ala | Ser | Phe | Val | Ala | Ser | Asn | Pro | Asn | Ala | Pro |
|     |     |     |     |     |     | 180 |     |     | 185 |     |     | 190 |     |     |     |
| Arg | Arg | Asn | Ala | Phe | Tyr | Glu | Ala | Leu | Asn | Ala | Ile | Glu | Pro | Val | Ala |
|     |     |     |     |     |     | 195 |     | 200 |     |     | 205 |     |     |     |     |
| Gly | Gly | Gly | Ser | Val | Lys | Asn | Thr | Leu | Gly | Tyr | Asn | Val | Lys | Asn | Lys |
|     |     |     |     |     |     | 210 |     | 215 |     |     | 220 |     |     |     |     |
| Ser | Glu | Phe | Leu | Ser | Gln | Tyr | Lys | Phe | Asn | Leu | Cys | Phe | Glu | Asn | Thr |
|     |     |     |     |     |     | 225 |     | 230 |     | 235 |     |     |     | 240 |     |
| Gln | Gly | Tyr | Gly | Tyr |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     | 245 |     |     |     |     |     |     |     |     |     |

<210> 24  
<211> 247  
<212> PRT  
<213> Helicobacter pylori

<220>  
<223> Helicobacter pylori strain 26695 Futa  
alpha-1,3/4-fucosyltransferase

<400> 24  
Met Phe Gln Pro Leu Leu Asp Ala Phe Ile Glu Ser Ala Ser Ile Glu  
1 5 10 15

Lys Met Ala Ser Lys Ser Pro Pro Pro Leu Lys Ile Ala Val Ala  
20 25 30

Asn Trp Trp Gly Asp Glu Glu Ile Lys Glu Phe Lys Lys Ser Val Leu  
35 40 45

Tyr Phe Ile Leu Ser Gln Arg Tyr Ala Ile Thr Leu His Gln Asn Pro  
50 55 60

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asn | Glu | Phe | Ser | Asp | Leu | Val | Phe | Ser | Asn | Pro | Leu | Gly | Ala | Ala | Arg |
| 65  |     |     |     |     | 70  |     |     |     | 75  |     |     |     |     |     | 80  |
| Lys | Ile | Leu | Ser | Tyr | Gln | Asn | Thr | Lys | Arg | Val | Phe | Tyr | Thr | Gly | Glu |
|     |     |     |     |     | 85  |     |     |     | 90  |     |     |     |     |     | 95  |
| Asn | Glu | Ser | Pro | Asn | Phe | Asn | Leu | Phe | Asp | Tyr | Ala | Ile | Gly | Phe | Asp |
|     |     |     |     |     |     | 100 |     |     | 105 |     |     |     |     |     | 110 |
| Glu | Leu | Asp | Phe | Asn | Asp | Arg | Tyr | Leu | Arg | Met | Pro | Leu | Tyr | Tyr | Ala |
|     |     |     |     |     |     | 115 |     |     | 120 |     |     |     |     |     | 125 |
| His | Leu | His | Tyr | Lys | Ala | Glu | Leu | Val | Asn | Asp | Thr | Thr | Ala | Pro | Tyr |
|     |     |     |     |     |     | 130 |     |     | 135 |     |     |     |     |     | 140 |
| Lys | Leu | Lys | Asp | Asn | Ser | Leu | Tyr | Ala | Leu | Lys | Lys | Pro | Ser | His | His |
|     |     |     |     |     |     | 145 |     |     | 150 |     |     | 155 |     |     | 160 |
| Phe | Lys | Glu | Asn | His | Pro | Asn | Leu | Cys | Ala | Val | Val | Asn | Asp | Glu | Ser |
|     |     |     |     |     |     | 165 |     |     | 170 |     |     |     |     |     | 175 |
| Asp | Leu | Leu | Lys | Arg | Gly | Phe | Ala | Ser | Phe | Val | Ala | Ser | Asn | Ala | Asn |
|     |     |     |     |     |     | 180 |     |     | 185 |     |     |     |     |     | 190 |
| Ala | Pro | Met | Arg | Asn | Ala | Phe | Tyr | Asp | Ala | Leu | Asn | Ser | Ile | Glu | Pro |
|     |     |     |     |     |     | 195 |     |     | 200 |     |     |     |     |     | 205 |
| Val | Thr | Gly | Gly | Ser | Val | Arg | Asn | Thr | Leu | Gly | Tyr | Lys | Val | Gly |     |
|     |     |     |     |     | 210 |     |     | 215 |     |     | 220 |     |     |     |     |
| Asn | Lys | Ser | Glu | Phe | Leu | Ser | Gln | Tyr | Lys | Phe | Asn | Leu | Cys | Phe | Glu |
|     |     |     |     |     |     | 225 |     |     | 230 |     |     | 235 |     |     | 240 |
| Asn | Ser | Gln | Gly | Tyr | Gly | Tyr |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     | 245 |     |     |     |     |     |     |     |     |     |     |

<210> 25

<211> 246

<212> PRT

<213> Helicobacter pylori

<220>

<223> Helicobacter pylori strain 1182 FutB  
alpha-1,3/4-fucosyltransferase

<400> 25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Phe | Gln | Pro | Leu | Leu | Asp | Ala | Tyr | Ile | Glu | Ser | Ala | Ser | Ile | Glu |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Lys | Ile | Thr | Ser | Lys | Ser | Pro | Pro | Pro | Leu | Lys | Ile | Ala | Val | Ala | Asn |
|     |     |     |     |     |     | 20  |     |     | 25  |     |     |     |     | 30  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Trp | Trp | Gly | Asp | Glu | Glu | Val | Glu | Glu | Phe | Lys | Lys | Asn | Ile | Leu | Tyr |
|     |     |     |     |     |     | 35  |     |     | 40  |     |     |     |     | 45  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Phe | Ile | Leu | Ser | Gln | His | Tyr | Thr | Ile | Thr | Leu | His | Gln | Asn | Pro | Asn |
|     |     |     |     |     |     | 50  |     |     | 55  |     |     |     |     | 60  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Glu | Pro | Ser | Asp | Leu | Val | Phe | Gly | Ser | Pro | Ile | Gly | Ser | Ala | Arg | Lys |
|     |     |     |     |     |     | 65  |     |     | 70  |     |     | 75  |     | 80  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ile | Leu | Ser | Tyr | Gln | Asn | Ala | Lys | Arg | Val | Phe | Tyr | Thr | Gly | Glu | Asn |
| 85  |     |     |     |     |     |     |     |     |     |     |     |     |     | 95  |     |
| Glu | Ser | Pro | Asn | Phe | Asn | Leu | Phe | Asp | Tyr | Ala | Ile | Gly | Phe | Asp | Glu |
| 100 |     |     |     |     |     |     |     |     |     |     |     |     |     | 110 |     |
| Leu | Asp | Phe | Arg | Asp | Arg | Tyr | Leu | Arg | Met | Pro | Leu | Tyr | Tyr | Asp | Arg |
| 115 |     |     |     |     |     |     |     |     |     |     |     |     |     | 125 |     |
| Leu | His | His | Lys | Ala | Glu | Ser | Val | Asn | Asp | Thr | Thr | Ser | Pro | Tyr | Lys |
| 130 |     |     |     |     |     |     |     |     |     |     |     |     |     | 140 |     |
| Leu | Lys | Pro | Asp | Ser | Leu | Tyr | Ala | Leu | Lys | Lys | Pro | Ser | His | His | Phe |
| 145 |     |     |     |     |     |     |     |     |     |     |     |     |     | 160 |     |
| Lys | Glu | Asn | His | Pro | Asn | Leu | Cys | Ala | Val | Val | Asn | Asn | Glu | Ser | Asp |
| 165 |     |     |     |     |     |     |     |     |     |     |     |     |     | 175 |     |
| Pro | Leu | Lys | Arg | Gly | Phe | Ala | Ser | Phe | Val | Ala | Ser | Asn | Pro | Asn | Ala |
| 180 |     |     |     |     |     |     |     |     |     |     |     |     |     | 190 |     |
| Pro | Lys | Arg | Asn | Ala | Phe | Tyr | Asp | Val | Leu | Asn | Ser | Ile | Glu | Pro | Val |
| 195 |     |     |     |     |     |     |     |     |     |     |     |     |     | 205 |     |
| Ile | Gly | Gly | Gly | Ser | Val | Lys | Asn | Thr | Leu | Gly | Tyr | Asn | Ile | Lys | Asn |
| 210 |     |     |     |     |     |     |     |     |     |     |     |     |     | 220 |     |
| Lys | Ser | Glu | Phe | Leu | Ser | Gln | Tyr | Lys | Phe | Asn | Leu | Cys | Phe | Glu | Asn |
| 225 |     |     |     |     |     |     |     |     |     |     |     |     |     | 240 |     |
| Ser | Gln | Gly | Tyr | Gly | Tyr |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     | 245 |     |     |     |     |     |     |     |     |     |

<210> 26  
<211> 246  
<212> PRT  
<213> Helicobacter pylori

<220>  
<223> Helicobacter pylori strain 1218 FutB  
alpha-1,3/4-fucosyltransferase

|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <400> 26 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Met      | Phe | Gln | Pro | Leu | Leu | Asp | Ala | Tyr | Ile | Glu | Ser | Ala | Ser | Ile | Glu |
| 1        |     |     |     |     |     |     |     |     |     |     |     |     |     | 15  |     |
| Lys      | Ile | Thr | Ser | Lys | Ser | Pro | Pro | Pro | Leu | Lys | Ile | Ala | Val | Ala | Asn |
| 20       |     |     |     |     |     |     |     |     |     |     |     |     |     | 30  |     |
| Trp      | Trp | Gly | Asp | Glu | Glu | Val | Glu | Glu | Phe | Lys | Lys | Asn | Ile | Leu | Tyr |
| 35       |     |     |     |     |     |     |     |     |     |     |     |     |     | 45  |     |
| Phe      | Ile | Leu | Ser | Gln | His | Tyr | Thr | Ile | Thr | Leu | His | Gln | Asn | Pro | Asn |
| 50       |     |     |     |     |     |     |     |     |     |     |     |     |     | 60  |     |
| Glu      | Pro | Ser | Asp | Leu | Val | Phe | Gly | Ser | Pro | Ile | Gly | Ser | Ala | Arg | Lys |
| 65       |     |     |     |     |     |     |     |     |     |     |     |     |     | 80  |     |
| Ile      | Leu | Ser | Tyr | Gln | Asn | Ala | Lys | Arg | Val | Phe | Tyr | Thr | Gly | Glu | Asn |
| 85       |     |     |     |     |     |     |     |     |     |     |     |     |     | 95  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Glu | Ser | Pro | Asn | Phe | Asn | Leu | Phe | Asp | Tyr | Ala | Ile | Gly | Phe | Asp | Glu |
| 100 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 110 |
| Leu | Asp | Phe | Arg | Asp | Arg | Tyr | Leu | Arg | Met | Pro | Leu | Tyr | Tyr | Asp | Arg |
| 115 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 125 |
| Leu | His | His | Lys | Ala | Glu | Ser | Val | Asn | Asp | Thr | Thr | Ser | Pro | Tyr | Lys |
| 130 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 140 |
| Leu | Lys | Pro | Asp | Ser | Leu | Tyr | Ala | Leu | Lys | Lys | Pro | Ser | His | His | Phe |
| 145 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 160 |
| Lys | Glu | Asn | His | Pro | Asn | Leu | Cys | Ala | Val | Val | Asn | Asn | Glu | Ser | Asp |
| 165 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 175 |
| Pro | Leu | Lys | Arg | Gly | Phe | Ala | Ser | Phe | Val | Ala | Ser | Asn | Pro | Asn | Ala |
| 180 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 190 |
| Pro | Lys | Arg | Asn | Ala | Phe | Tyr | Asp | Ala | Leu | Asn | Ser | Ile | Glu | Pro | Val |
| 195 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 205 |
| Ile | Gly | Gly | Gly | Ser | Val | Lys | Asn | Thr | Leu | Gly | Tyr | Asn | Ile | Lys | Asn |
| 210 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 220 |
| Lys | Ser | Glu | Phe | Leu | Ser | Gln | Tyr | Lys | Phe | Asn | Leu | Cys | Phe | Glu | Asn |
| 225 |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 240 |
| Ser | Gln | Gly | Tyr | Gly | Tyr |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 245 |

<210> 27  
 <211> 247  
 <212> PRT  
 <213> Helicobacter pylori

<220>  
 <223> Helicobacter pylori strain 19C2 FutB  
 alpha-1,3/4-fucosyltransferase

|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <400> 27 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Met      | Phe | Gln | Pro | Leu | Leu | Asp | Ala | Tyr | Ile | Asp | Ser | Thr | Arg | Leu | Asp |
| 1        |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 15  |
| Glu      | Thr | Asp | Tyr | Lys | Pro | Pro | Leu | Asn | Ile | Ala | Leu | Ala | Asn | Trp | Trp |
|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 20       |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 30  |
| Pro      | Leu | Asp | Lys | Arg | Glu | Ser | Lys | Gly | Phe | Arg | Lys | Lys | Phe | Ile | Leu |
|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 35       |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 45  |
| His      | Phe | Ile | Leu | Ser | Gln | His | Tyr | Thr | Ile | Ala | Leu | His | Arg | Asn | Pro |
|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 50       |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 60  |
| Asp      | Lys | Pro | Ala | Asp | Ile | Val | Phe | Gly | Asn | Pro | Leu | Gly | Ser | Ala | Arg |
|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 65       |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 80  |
| Lys      | Ile | Leu | Ser | Tyr | Gln | Asn | Ala | Lys | Arg | Val | Phe | Tyr | Thr | Gly | Glu |
|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 85       |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 95  |
| Asn      | Glu | Val | Pro | Asn | Phe | Asn | Leu | Phe | Asp | Tyr | Ala | Ile | Gly | Phe | Asp |
|          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 100      |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 110 |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Glu | Leu | Asp | Phe | Arg | Asp | Arg | Tyr | Leu | Arg | Met | Pro | Leu | Tyr | Tyr | Asp |
| 115 |     |     |     |     |     |     |     | 120 |     |     |     |     | 125 |     |     |
| Arg | Leu | His | His | Lys | Ala | Glu | Ser | Val | Asn | Asp | Thr | Thr | Ala | Pro | Tyr |
| 130 |     |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Lys | Ile | Lys | Ser | Asp | Ser | Leu | Tyr | Ala | Leu | Lys | Lys | Pro | Ser | His | His |
| 145 |     |     |     |     |     | 150 |     |     |     | 155 |     |     |     | 160 |     |
| Phe | Lys | Glu | Asn | His | Pro | His | Leu | Cys | Ala | Leu | Ile | Asn | Asn | Glu | Ile |
|     |     |     |     |     |     |     | 165 |     |     | 170 |     |     |     | 175 |     |
| Asp | Pro | Leu | Lys | Arg | Gly | Phe | Ala | Ser | Phe | Val | Ala | Ser | Asn | Pro | Asn |
|     |     |     |     |     |     |     | 180 |     |     | 185 |     |     |     | 190 |     |
| Ala | Pro | Ile | Arg | Asn | Ala | Phe | Tyr | Glu | Ala | Leu | Asn | Ser | Ile | Glu | Pro |
|     |     |     |     |     |     |     | 195 |     |     | 200 |     |     |     | 205 |     |
| Val | Thr | Gly | Gly | Ser | Val | Arg | Asn | Thr | Leu | Gly | Tyr | Asn | Val | Lys |     |
|     |     |     |     |     |     | 210 |     |     | 215 |     |     |     | 220 |     |     |
| Asn | Lys | Asn | Glu | Phe | Leu | Ser | Gln | Tyr | Lys | Phe | Asn | Leu | Cys | Phe | Glu |
|     |     |     |     |     |     | 225 |     |     | 230 |     |     |     | 235 |     | 240 |
| Asn | Thr | Gln | Gly | Tyr | Gly | Tyr |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     | 245 |     |     |     |     |     |     |     |     |     |

<210> 28

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 28

|     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Phe | Gln | Pro | Leu | Leu | Asp | Ala | Phe | Ile | Glu | Ser | Ala |
| 1   |     |     |     |     |     |     |     | 5   |     |     |     | 10  |

<210> 29

<211> 16

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 29

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pro | Pro | Leu | Lys | Ile | Ala | Val | Ala | Asn | Trp | Trp | Gly | Asp | Glu | Glu | Ile |
| 1   |     |     |     |     |     |     |     |     | 5   |     |     |     | 10  |     | 15  |

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<210> 30
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 30
Ile Leu Tyr Phe Ile Leu Ser Gln His Tyr Thr Ile Thr Leu His
  1           5           10           15

<210> 31
<211> 32
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 31
Pro Ala Asp Ile Val Phe Gly Asn Pro Leu Gly Ser Ala Arg Lys Ile
  1           5           10           15

Leu Ser Tyr Gln Asn Ala Lys Arg Val Phe Tyr Thr Gly Glu Asn Glu
  20          25           30

<210> 32
<211> 28
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 32
Pro Asn Phe Asn Leu Phe Asp Tyr Ala Ile Gly Phe Asp Glu Leu Asp
  1           5           10           15

Phe Arg Asp Arg Tyr Leu Arg Met Pro Leu Tyr Tyr
  20          25

<210> 33
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

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<400> 33
Leu His His Lys Ala Glu
1 5

<210> 34
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 34
Val Asn Asp Thr Thr Ser Pro Tyr Lys Leu Lys
1 5 10

<210> 35
<211> 46
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 35
Asp Ser Leu Tyr Ala Leu Lys Lys Pro Ser His His Phe Lys Glu Asn
1 5 10 15

His Pro Asn Leu Cys Ala Val Val Asn Asn Glu Ser Asp Pro Leu Lys
20 25 30

Arg Gly Phe Ala Ser Phe Val Ala Ser Asn Pro Asn Ala Pro
35 40 45

<210> 36
<211> 14
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 36
Arg Asn Ala Phe Tyr Asp Ala Leu Asn Ser Ile Glu Pro Val
1 5 10

<210> 37
<211> 37
<212> PRT
<213> Artificial Sequence

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<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 37  
Gly Gly Gly Ser Val Lys Asn Thr Leu Gly Tyr Asn Val Lys Asn Lys  
1 5 10 15

Ser Glu Phe Leu Ser Gln Tyr Lys Phe Asn Leu Cys Phe Glu Asn Ser  
20 25 30

Gln Gly Tyr Gly Tyr  
35

<210> 38  
<211> 333  
<212> DNA  
<213> Helicobacter pylori

<220>  
<223> Helicobacter pylori strain 915 FutA (915A.cod  
(MWG)) alpha-1,3/4-fucosyltransferase

<400> 38  
atgttccaac ccctattaga tgccttata gaaagcgctt ccattgaaaa aatggcctct 60  
aatctcccc ccctaaaaat cgctgtggcg aattggtggg gagatgaaga aattaaaaaa 120  
tttaaaaaga gcgttctta ttttaccta agccagcatt acacaatcac tttacaccga 180  
aacccctgata aacctgcgga catcgcttt ggttaacccccc ttggatcagc cagaaaaatc 240  
ttatcctatc aaaacgcaaa aagggtgtt tacaccggtg aaaaatgaagt ccctaacttc 300  
aacctcttg attacgccat aggctttga tga 333

<210> 39  
<211> 53  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 39  
atgttccaac ccctattaga cgcccttata gaaagcgctt ccattgaaaa aat 53

<210> 40  
<211> 20  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 40  
gcctctaaat ctcccccccc 20

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<210> 41
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 41
taaaaatcgc tgtggcgaat tggtagg                                26

<210> 42
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 42
agaaattaaa gaatttaaaa aga                                23

<210> 43
<211> 17
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 43
cagcattaca caatcac                                17

<210> 44
<211> 10
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 44
tcgtctttgg                                10

<210> 45
<211> 44
<212> DNA
<213> Artificial Sequence

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<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 45
cttggatcag ccagaaaaat cttatcctat caaaacgcaa aaag           44

<210> 46
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 46
gtgttttaca ccggtgaaaa cgaa           24

<210> 47
<211> 36
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 47
cctaatttca acctcttga ttacgccata ggctt           36

<210> 48
<211> 11
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 48
gatgaattgg a           11

<210> 49
<211> 17
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

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<400> 49  
tttagagatc gttattt

17

<210> 50  
<211> 11  
<212> DNA  
<213> Artificial Sequence  
  
<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 50  
agaatgcctt t

11

<210> 51  
<211> 11  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 51  
ataaaagccga g

11

<210> 52  
<211> 12  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 52  
aatgacacca ct

12

<210> 53  
<211> 17  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 53  
cgccttacaa actcaaa

17

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<210> 54
<211> 55
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 54
ctgacagcct ttatgcttta aaaaaaccct cccatcattt taaagaaaaac caccc      55

<210> 55
<211> 14
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 55
tgcgcagtag tgaa                                         14

<210> 56
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 56
aatgagagcg atccttgaa aagagggttt gcgag               35

<210> 57
<211> 19
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 57
agcaacccta acgctccta                                         19

<210> 58
<211> 14
<212> DNA
<213> Artificial Sequence

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<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 58
gctttaatt ctat                                14

<210> 59
<211> 10
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 59
gagccagttt                                10

<210> 60
<211> 17
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 60
tggggggaggg agcgtga                                17

<210> 61
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 61
aaacacttta ggctataa                                18

<210> 62
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

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<400> 62  
agcgagttt taagccaata caa

23

<210> 63  
<211> 21  
<212> DNA  
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<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 63  
ttcaatctgt gttttgaaaa c

21

<210> 64  
<211> 41  
<212> DNA  
<213> Artificial Sequence  
  
<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 64  
caaggctatg gctatgtaac tgaaaaaaatc attgacgctt a

41

<210> 65  
<211> 27  
<212> DNA  
<213> Artificial Sequence  
  
<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 65  
agccataccca ttcctattta ttgggggg

27

<210> 66  
<211> 16  
<212> DNA  
<213> Artificial Sequence  
  
<220>  
<223> Description of Artificial Sequence:Helicobacter  
pylori alpha-1,3/4-fucosyltransferase consensus  
sequence

<400> 66  
aagattttaa ccctaa

16

|   |  |    |
|---|--|----|
| <210> 67  |  |    |
| <211> 14  |  |    |
| <212> DNA   |  |    |
| <213> Artificial Sequence                             |  |    |
| <br>  |  |    |
| <220>   |  |    |
| <223> Description of Artificial Sequence:Helicobacter |  |    |
| pylori alpha-1,3/4-fucosyltransferase consensus       |  |    |
| sequence  |  |    |
| <br>  |  |    |
| <400> 67  |  |    |
| agttttgtga atgt                                       |  | 14 |
| <br>  |  |    |
| <210> 68  |  |    |
| <211> 17  |  |    |
| <212> DNA   |  |    |
| <213> Artificial Sequence                             |  |    |
| <br>  |  |    |
| <220>   |  |    |
| <223> Description of Artificial Sequence:Helicobacter |  |    |
| pylori alpha-1,3/4-fucosyltransferase consensus       |  |    |
| sequence  |  |    |
| <br>  |  |    |
| <400> 68  |  |    |
| tttgatgaag cgattga                                    |  | 17 |
| <br>  |  |    |
| <210> 69  |  |    |
| <211> 33  |  |    |
| <212> DNA   |  |    |
| <213> Artificial Sequence                             |  |    |
| <br>  |  |    |
| <220>   |  |    |
| <223> Description of Artificial Sequence:Helicobacter |  |    |
| pylori alpha-1,3/4-fucosyltransferase consensus       |  |    |
| sequence  |  |    |
| <br>  |  |    |
| <400> 69  |  |    |
| tgcacacgca cccaaacgct tatttagaca tgc                  |  | 33 |
| <br>  |  |    |
| <210> 70  |  |    |
| <211> 20  |  |    |
| <212> DNA   |  |    |
| <213> Artificial Sequence                             |  |    |
| <br>  |  |    |
| <220>   |  |    |
| <223> Description of Artificial Sequence:Helicobacter |  |    |
| pylori alpha-1,3/4-fucosyltransferase consensus       |  |    |
| sequence  |  |    |
| <br>  |  |    |
| <400> 70  |  |    |
| tatgaaaacc cttaaacac                                  |  | 20 |
| <br>  |  |    |
| <210> 71  |  |    |
| <211> 26  |  |    |
| <212> DNA   |  |    |
| <213> Artificial Sequence                             |  |    |

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<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 71
ttgatggaa agcttacttt taccaa                                         26

<210> 72
<211> 40
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 72
atttgagttt taaaaaaatc ctagattttt ttaaaacgat                                         40

<210> 73
<211> 11
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 73
ttagaaaacg a                                         11

<210> 74
<211> 38
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:Helicobacter
      pylori alpha-1,3/4-fucosyltransferase consensus
      sequence

<400> 74
ttgagggtta attatgatga tttgagggtt aattatga                                         38

<210> 75
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:FLAG tag
      epitope tag

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<400> 75  
Asp Tyr Lys Asp Asp Asp Asp Lys  
1 5

<210> 76  
<211> 6  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:hexahistidine  
affinity tag, purification tag

<400> 76  
His His His His His  
1 5